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10/712,495	11/13/2003	Frank Jansen	M02A430	8327

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EXAMINER	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/712,495
Filing Date: November 13, 2003
Appellant(s): JANSEN, FRANK

MAILED
AUG 21 2006
GROUP 1700

David A. Hey
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed June 1, 2006 appealing from the Office action mailed November 8, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

There are no amendments after final to be entered.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

It should be noted that the correct patent number for Satta et al. is 6,391,785.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2003/0180458	SNEH	9-2003
6,391,785	SATTA et al.	5-2002
6,287,965	KANG et al.	9-2001

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 11-17 rejected under 35 U.S.C. 102(e) as being anticipated by Sneh (US Patent Application Publication 2003/0180458).

Sneh discloses a method of delivering precursor gasses for an ALD process comprising filling a first booster chamber with a first chemical reactant (paragraph 46) and filling a second booster chamber with a second chemical reactant (paragraph 47). To fill these chambers, chemical-dosage shut-off valves (110 and 110') between the booster chambers and the atomic layer deposition chamber must be closed (Figure 1 and Table 1). The chamber is purged between adding each reactant at a pressure below that of the pressure during the dosage of the reactants (paragraph 87, Table 1, Table 3). To add each chemical reactant the valves (110 and 110') must be opened to allow the reactants to flow into the reaction chamber. The process runs in the general procedure of: adding the first reactant (opening its shut-off valve); purging (closing the 1st shut off valve); adding the second reactant (opening its shut off valve); purging (closing 2nd shut off valve) and repeating that sequence of steps (paragraphs 14-19, table 1). This process is run solely under a pressure gradient (paragraph 38, paragraph 89).

Referring to claims 12 and 13, Sneh discloses purging with an inert gas at a reduced pressure in between the steps of adding the reactants (paragraph 10, table 3).

Referring to claim 14, Sneh discloses that the first reactant can be trimethylaluminum (paragraph 152).

Referring to claim 15, Sneh discloses that the second reactant can be water.

Referring to claim 16, Sneh discloses that the booster chambers are connected to gas supplies (105 and 105') (figure 1, paragraph 83).

Referring to claim 17, it is inherent that the chemical-dosage shut-off valves must be closed when filling the booster chambers from the precursor gas supply to prevent unwanted transport of the precursor gas to the reaction chamber.

Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Satta et al. (US Patent No. 6,391,785) in view of Sneh.

Satta et al. discloses a method for forming a titanium nitride barrier layer using an ALD process. The method uses $TiCl_4$ as the first reactant and NH_3 as the second reactant (table 1, column 12 lines 23-28). However, Satta et al. does not disclose using a booster chamber as a method of performing the ALD reaction. The method of Sneh teaches that ALD is preferably practiced with the highest possible flow rate of purge gas and the lowest possible flow rate of reactants (paragraph 34). Sneh also proposes a method that teaches using booster chambers to help maximize the flow of the purge gas and minimize the flow of the reactant gasses, as discussed above this method meets all the requirements of claims 11 and 16. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Satta et al. to use the method suggested by Sneh with an expectation that it will achieve significant modulation of flow rates between the reactant gas and purge gas steps.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sneh as applied to claims 11-17 above, and further in view of Kang et al. (US Patent No. 6,287,965).

Sneh discloses using nitrogen as a purge gas for an ALD process, but does not disclose using argon. However, Kang et al. teaches using either nitrogen or argon as a purge gas for an ALD reaction (column 13 lines 36-49). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Sneh to use argon as a purge gas instead of nitrogen as Kang et al. suggests that they are both capable of performing the exact same function.

(10) Response to Argument

It is noted that the sole issue is whether the prior art references teach allowing a precursor gas to flow from an auxiliary chamber to an inlet of the process reactor solely under a pressure gradient (p.7 first and third paragraphs of the Appeal Brief, paragraph bridging pp.7-8, p.10 last paragraph, p.11second full paragraph).

Appellant argues that Sneh does not teach or suggest an ALD method wherein precursor gas flows from auxiliary chambers to an inlet of the process chamber solely under a pressure gradient (p.10 last paragraph).

The examiner disagrees. It is first noted that nowhere in the instant claims is there any recitation of an ALD process. Hence, appellant's arguments are not commensurate in scope with the instant claims. In addition, it is noted that Sneh teaches flowing a precursor from the booster chamber 107 to the process chamber 114 (paragraphs 46-47). It is the examiner's position that the booster chamber of Sneh meets the limitation of the auxiliary chamber of the claimed invention.

With respect to the limitation of flowing a gas "solely under a pressure gradient", it is first noted that there is no specific definition of pressure gradient mentioned in the specification (paragraphs 1, 9, 15, 18). That being said, the examiner does not challenge the definition of pressure gradient set forth on p.11 first full paragraph of the Appeal Brief, which defines a pressure gradient as a "movement caused by a differential in pressure between two different areas". One skilled in the art knows that flow of gas occurs if there is a pressure differential between two different areas. Simply put, if there is gas flow, there is a pressure differential.

Sneh clearly teaches of flowing gas from a booster chamber to a deposition chamber as noted above. The flow of gas must occur by a pressure differential.

It is further noted that the claimed invention does not restrict how the pressure gradient occurs just that flow occurs by a pressure gradient. One skilled in the art would realize that a pressure gradient can simply be provided by increasing the pressure at the initial area and/or decreasing the pressure at the final area. Appellant's claimed invention requires that the process include reducing the pressure in the reactor chamber (claim 11, lines 6 and 11) and that this can be done by the use of a vacuum pump (paragraphs 14-15 and 26 of the specification). Sneh clearly teaches the use of a vacuum pump 125 to reduce pressure in the chamber (paragraphs 86, 127, and Figure 1). In addition, a pressure gradient can be created by the use of high pressure gas cylinders, typical for an ALD process, at the beginning of a gas line. Appellant does not preclude the use of a pressurized gas source but even contemplates its use (paragraph 22 of the specification). It is the examiner's position that Sneh's use of a vacuum pump and/or the use of a pressurized gas source would inherently provide the pressure gradient to cause flow from the booster chamber to the deposition chamber.

Appellant next argues that Sneh does not teach flow solely due to a pressure gradient because Sneh uses a number of elements to create the desired flow such as booster chambers, a gas distribution chamber, a draw control chamber, a pump, and numerous flow restrictors and valves (p.11 line 16 – p.12 line 10 of the Appeal Brief).

The examiner disagrees. As mentioned above, it is first noted that the appellant does not provide any limitations as to how the pressure gradient occurs. Hence, the use of a gas distribution chamber, a draw control chamber, a pump, and numerous flow restrictors and valves in Sneh's process is not precluded by the claimed invention. These elements can be used, by Appellant's admission, to overcome the problem of pressure variations (p.12 line 22 of the Appeal Brief). The skilled artisan would realize that the use of these elements would produce a "consistent" pressure gradient. Assuming arguendo, that these elements are not used solely for the purpose of controlling the pressure gradient, the appellant has not provided any factual evidence to show that flow can occur other than by a pressure gradient. Certainly, there is no evidence of record to show that the gas flow of Sneh's process occurred other than solely by a pressure gradient.

Appellant makes no additional arguments with respect to the Satta reference (p.13) or the Kang reference (p.14).

In summary, the lone issue is whether the flow of gas occurs solely under a pressure gradient. It is the examiner's position that the flow of gas can only occur if a pressure gradient is present and that Sneh teaches a gas flow.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

B. Chen
August 16, 2006

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